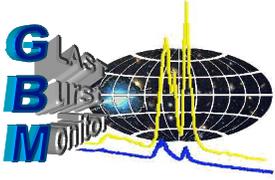


Monitoring Accreting X-ray Pulsars with the GLAST Burst Monitor

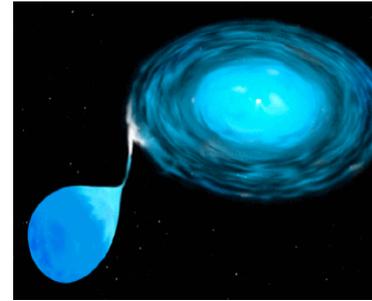
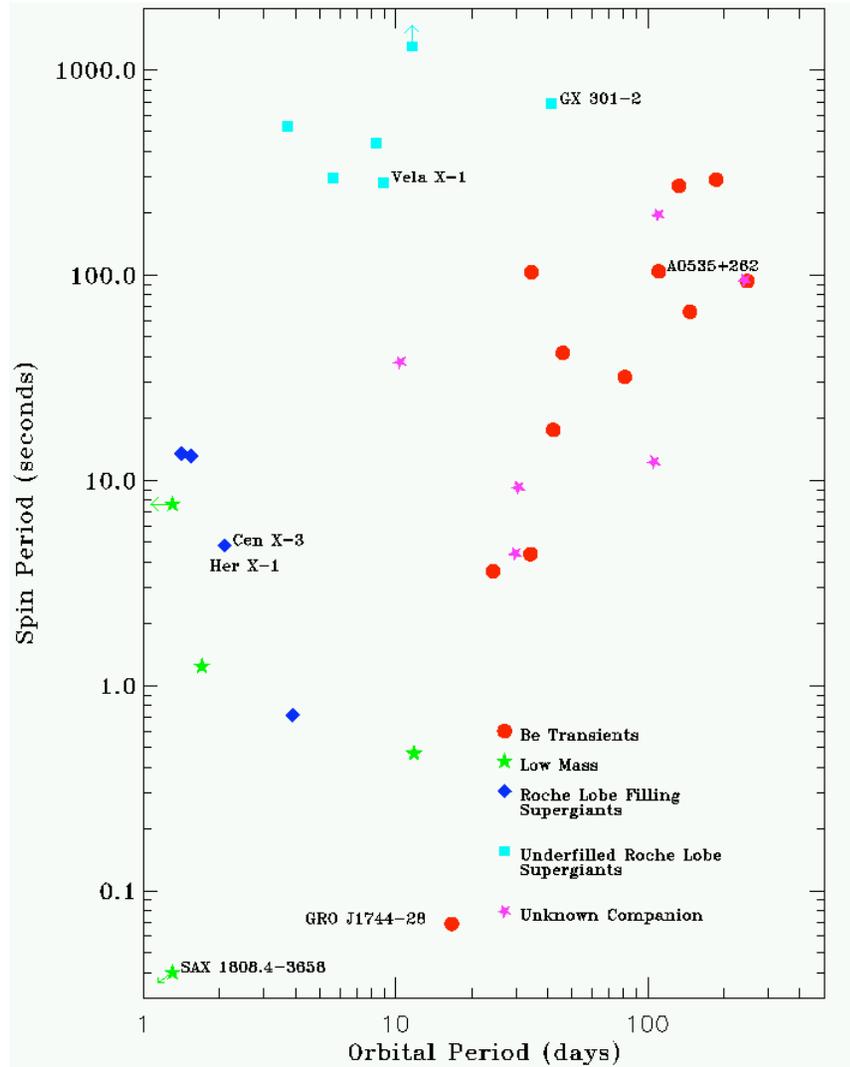
Colleen A. Wilson, M. H. Finger,
S. K. Patel, P. N. Bhat, R. D. Preece,
C. A. Meegan (NSSTC)



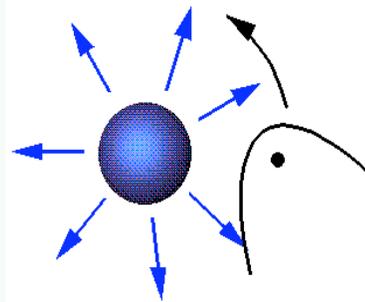
Outline

- Introduction
- Examples of BATSE results
- Basic Technique
- Estimated sensitivity
- Summary

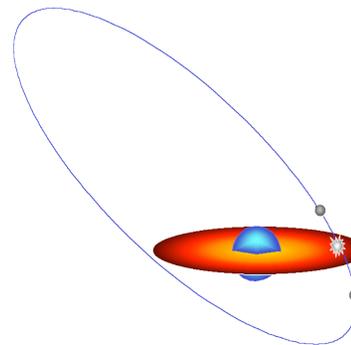
Accreting X-ray Pulsars



**Roche lobe
overflow**

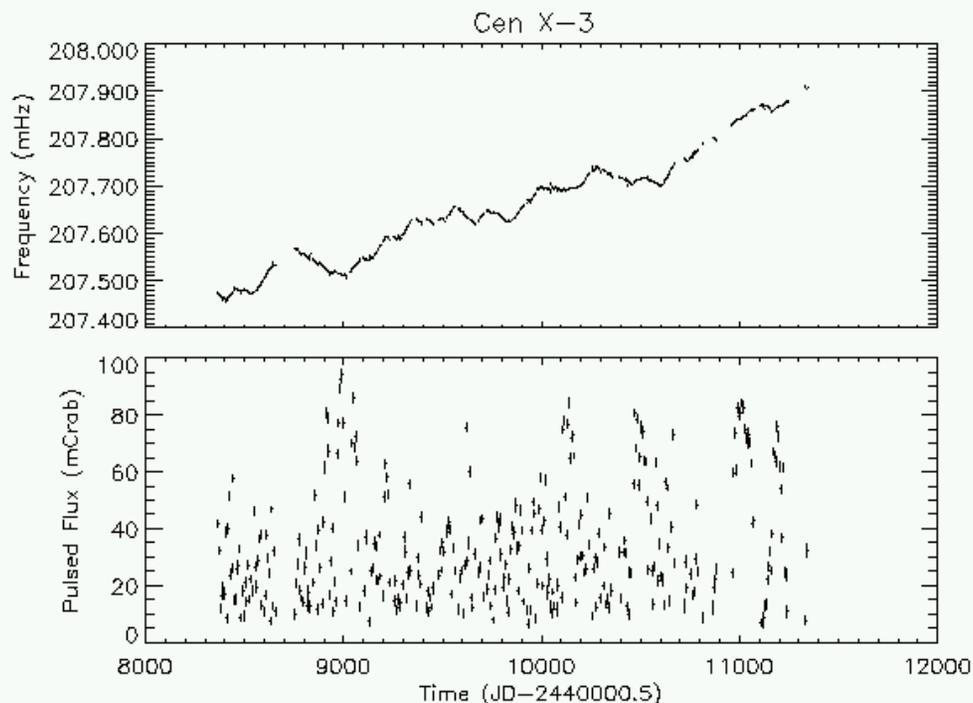
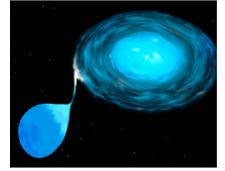


**Wind
accretion**

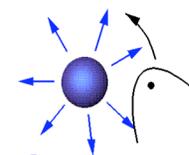


**Be star's
circumstellar
disk**

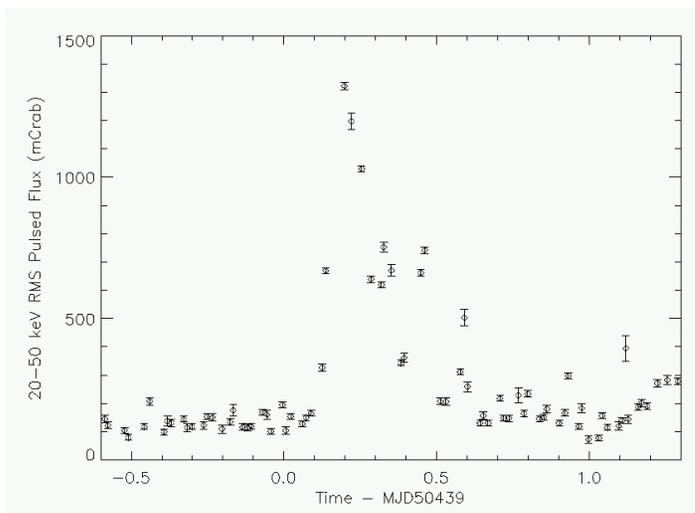
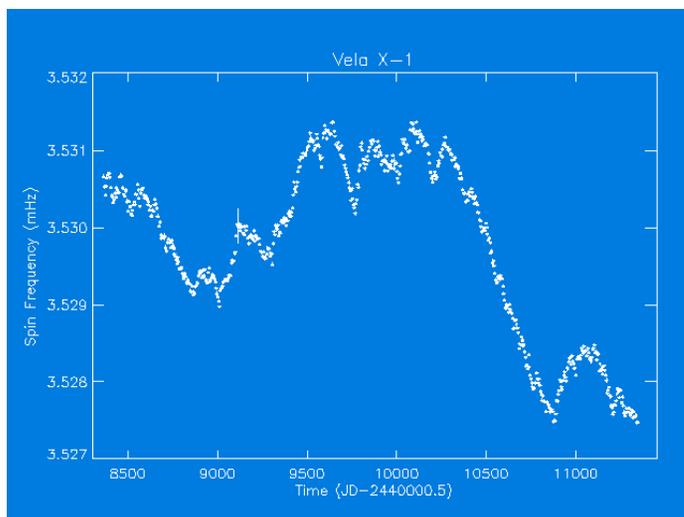
Cen X-3: a 4.8 s Disk-fed Pulsar



- The only Roche-lobe filling, high-mass supergiant system observed with BATSE.
- Bright, persistent, eclipsing pulsar in a 2.1-day orbit
- Alternates about 10-100 day intervals of spin-up and spin-down at a constant rate (Finger et al. 1994)
- Possible evidence for variable EGRET source (Vestrand et al. 1997)

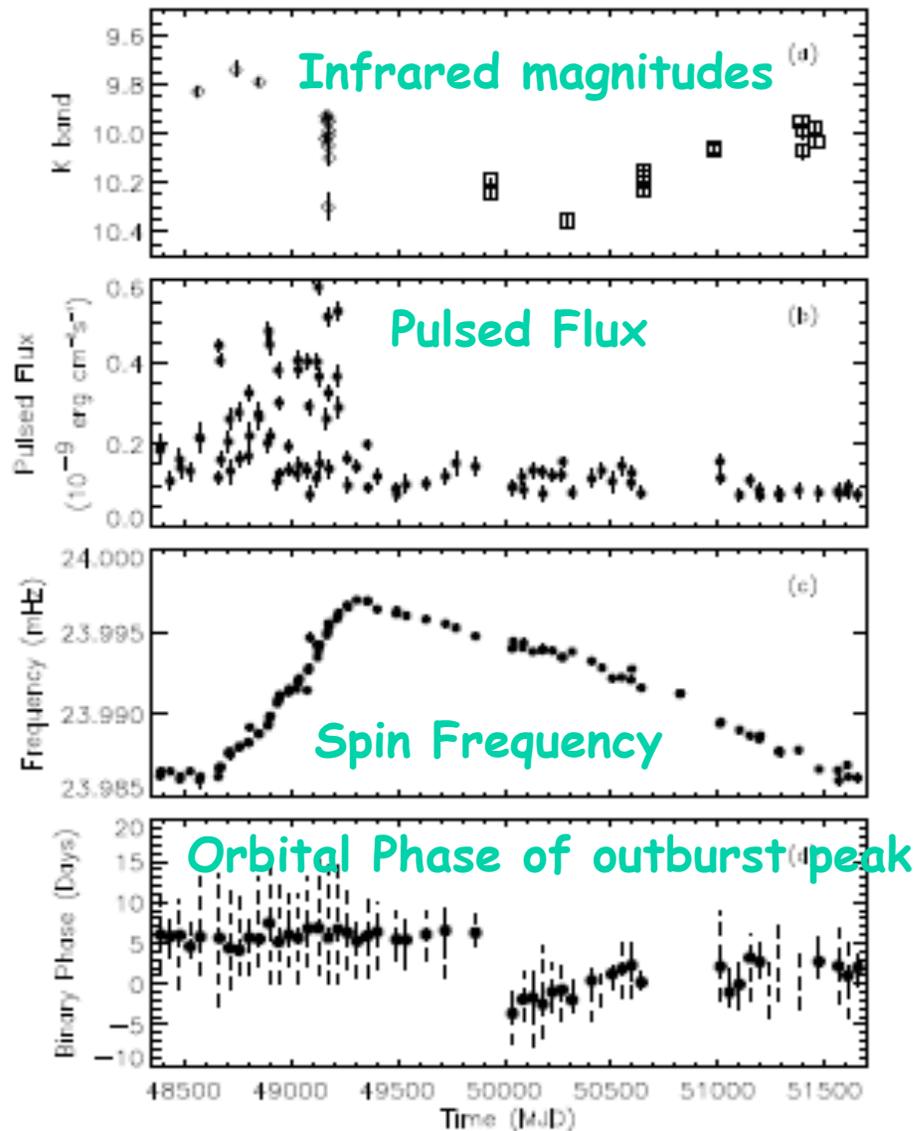
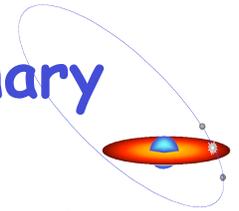


Vela X-1: a 283-s Wind-fed Pulsar



- Episodes of spin-up and spin-down with frequent reversals.
- Eclipses of the pulsar by its supergiant companion last about 2 days in its 8.96-day orbit.
- Large flares, like that observed with Integral in 2003, were also seen with BATSE

EXO 2030+375: a 42-s Pulsar in a Be/X-ray Binary



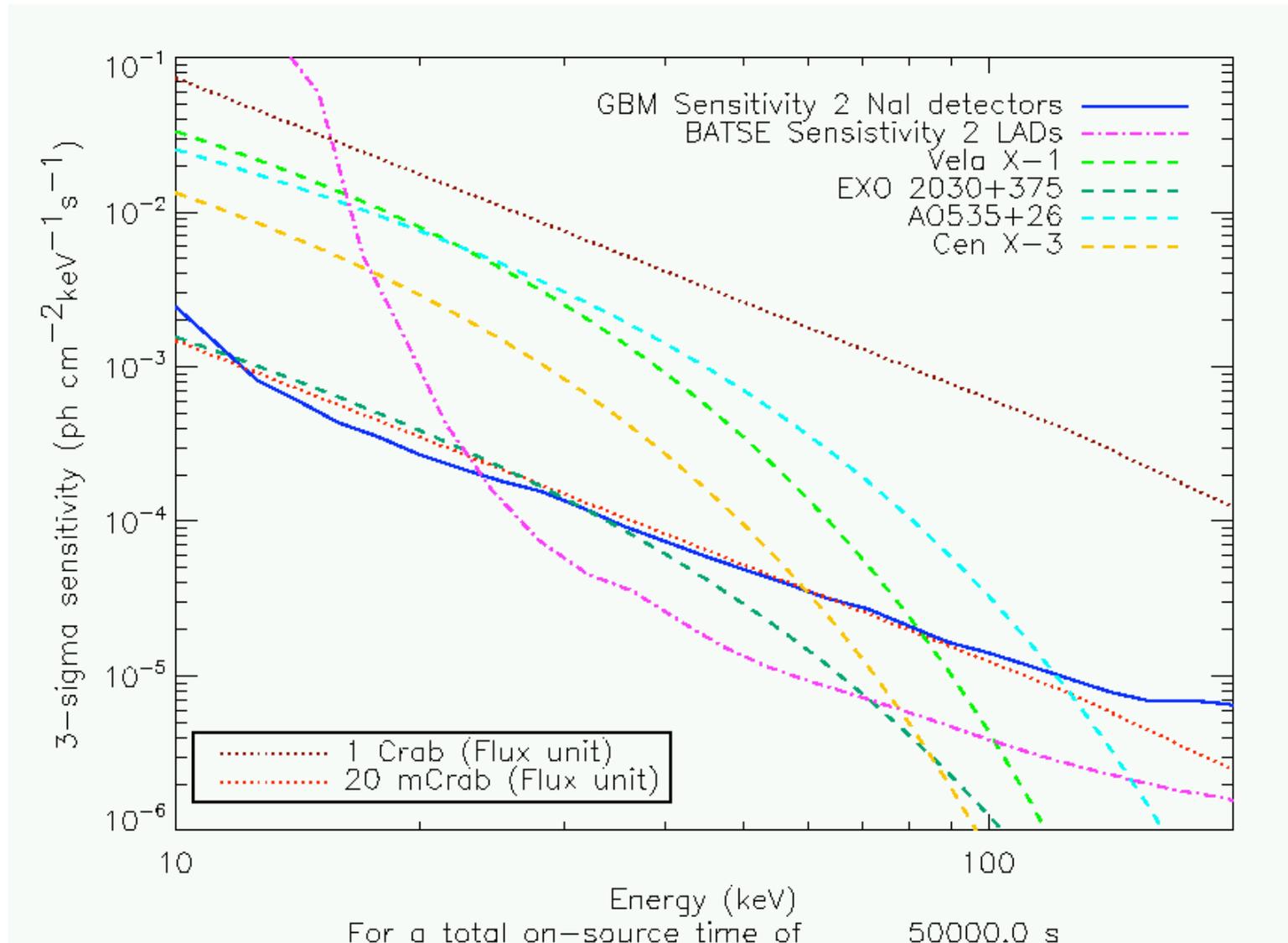
- There are two disks in this system: an excretion disk around Be star and accretion disk around pulsar.
- A decline in the density of the Be star's disk caused a drop in pulsed flux and a transition from spin-up to spin-down.
- The orbital phase of the transient outbursts shifted in 1995, accompanied by a change in the $H\alpha$ profile, indicating the presence of a global one-armed oscillation in the Be disk.

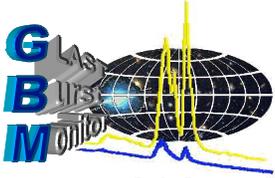
(Wilson et al. 2002, *ApJ*, 570, 287)

Basic Technique

- Use all data when pulsar of interest is above the horizon.
- Fit short segments (~ 300 s) of data with a background model and a pulse profile model.
- Do a grid search in frequency offset from the original model, aligning and combining all profiles in a longer time interval, using a modified Z^2 test.
- Account for aperiodic noise using a fit to a mean pulse profile or a power spectrum.

Estimated GBM Pulsed Flux Sensitivity





Summary

- We plan to propose a monitor, based upon BATSE heritage, to measure spin frequency and pulsed flux with GBM.
- This monitor would provide ephemerides (spin and orbital) for investigation of potential LAT counterparts, if any.
- The fortunate combination of the GBM sensitivity below 25 keV and the shape of typical pulsar spectra make this monitor able to detect the majority of sources detected with BATSE.
- This technique is much more sensitive than Earth Occultation because it uses all of the data when the source is above the horizon, but it is only suited for pulsed sources.
- The continuous data types provided by GBM are well suited to this task. (CTIME: 0.064-1.024 s time resolution, 8 energy channels)